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PÖYRY POINT OF VIEW - SEPTEMBER 2017

New packaging materials – the balancing act

In the ideal world, packaging is based on renewable resources and is reusable, recyclable, water-soluble, fully compostable or even edible

We have all heard about sustainable, smart, intelligent, cradle-to-cradle and other novel forms of packaging. However, have you ever heard about 'would be nice' or 'WBN' packaging?

Imagine the scenario in which each one of us is responsible for our own packaging waste. The packaging rubbish we create does not disappear in a dustcart, the environment or our oceans; instead, it is processed in our own households.

In this scenario there is very little packaging waste to begin with. Products are sold in packages which use a minimal and absolutely necessary amount of packaging material based on renewable resources to guarantee e.g. product integrity and safety. As consumers, we know exactly what to do with each packaging waste item.

In this ideal world the majority of packaging is mechanically and economically recyclable and after being processed in our household shredders or compacters it is returned to the production loop as raw material for new products. The rest lands in our community waste-to-energy incinerator which does not emit any harmful gasses.

The fraction that is not recycled can also be water-soluble, fully compostable or even edible. The first signs of edible packages have been around for decades e.g. in the form of taco shells and ice-cream cones.

STEPS TOWARDS THE IDEAL WORLD

This is a dream scenario, of course – at least for now. But whilst we can only dream about this world, producers of packaging materials are doing their best to develop ever more sustainable packaging. The goal is to balance the primary functions of packaging such as product containment, protection and information as well as branding, convenience, long shelf life etc. with the demands for circular packaging – i.e. packaging that is designed with due consideration for the beginning and end of life utilisation.

Currently, the packaging materials experiencing an introduction of numerous innovative solutions are paper and plastics. These two materials, whilst competing in a number of end use applications, are increasingly adopting each other's best properties.

PAPER AND BOARD: WHAT TO DO WITH POLYETHYLENE AND ALUMINIUM?

Paper and board packaging materials continue to dominate packaging overall despite progressively losing their market share, challenged by plastics. The use of paper board for applications such as liquid containers or coffee cups is under increasing scrutiny due to the recycling issues related to the materials. All board for liquid packaging and hot drink cups is coated, in the vast majority of cases with polyethylene. Liquid packaging containers additionally have an aluminium layer. The recycling of these multilayer materials is technically feasible already, but widespread recycling infrastructure is not yet there.

For a number of years, the hurdles in the replacement of fossil fuel based polyethylene coating with bio-based plastics such as green polyethylene or PLA have been economic rather than technical, as these sustainable solutions are more expensive. However, the additional cost deriving from bio-based plastics has a marginal effect on the total cost of the packaging and even smaller on the price of the final product. An increasing number of consumer brands are seeing sustainable packaging as a commercial investment in brand image.

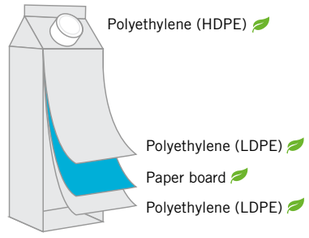
Whilst a fully circular liquid packaging container or coffee cup looks increasingly achievable, the replacement of aluminium in aseptic liquid packaging is likely to remain a major challenge for quite some time.

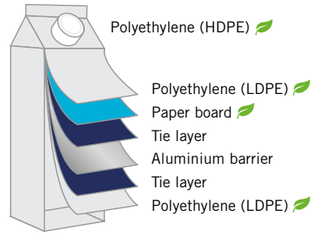
Recently, the use of microfibrillated cellulose has provided an additional boost to board performance. Nanocellulose provides much needed light-weighting – and thus a decrease in raw material demand – without compromising packaging strength and stiffness. Liquid packaging containers are already benefiting from these innovations in the continuous fight for their market share.

CASE STUDY: RENEWABLE POLYETHYLENE IN LIQUID CARTONS

Two liquid carton producers, Tetra Pak and Elopak, have chosen to offer cartons featuring renewable polyethylene (PE) both in the caps and in the coating of the board. Tetra Pak uses Braskem's "Green PE" which originates from Brazilian sugarcane, whereas Elopak coats their board with renewable PE from waste feedstocks that are ISCC PLUS certified with the mass balance approach. Bio-based or renewable polyethylene is believed to be sold at a price premium between 10-60%, depending on the market, application and client. For instance, 30% price premium would increase the coating cost of 1 litre carton by 0.009 EUR/carton. Premium soy milk is sold at a European hypermarket for a price of 2.69 EUR/litre – would more sustainable packaging justify one or two cent higher price for the product?

	Fossil-based PE	Renewable PE
Premium	0%	30%
Cost of PE coating for 1ltr carton	0.8 EUR cents	0.9 EUR cents





PLASTIC: IS SYNTHETIC BIOLOGY THE ANSWER?

The most commonly used polymer for consumer plastic packaging is PET. There has been a great deal of innovation in this segment. With light weighting of the PET bottle reaching its limit and the demands of circular economy combined with renewability of raw materials becoming increasingly important, Coca Cola challenged themselves to produce the world's first PET bottle based on 100% renewable resources.

While the effort of scaling up continues and Coca Cola has been joined by Nestle Waters, Danone, Suntory and Toyota in the race to reach commercial scale of the 100% bio-based PET bottle, there have been inspiring efforts towards replacing PET altogether. An example is PEF bottle which has better performance compared to PET – and it is made entirely from sugars. A dream come true?

In terms of market share, bio-based plastics converted into packaging are like a drop in the ocean. Although bio-based plastic packaging has been growing at double digits, less than 1% of plastics are currently derived from biomass and even less are compostable.

Rapidly advancing synthetic biology is now opening up new opportunities for plastic materials which, when produced at affordable price level, can redefine plastic packaging altogether. For instance, these novel materials can be engineered to degrade in any environment – including our oceans.

The race continues so it is not a matter of if, but when we will have packaging that meets all the challenges of today. The dream of WBN packaging may be a reality sooner than we anticipate.

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